

LEVEL

System Development Corporation

ADA 087679

14

TM-SV-5855/000/01

15 May 1980

11

12

54

2

6

SOFTWARE INTERFACE SPECIFICATION.

10 Warren / Swamura

SPONSORED BY: Defense Advanced Research Projects Agency (DoD)
ARPA Order Number 3830

MONITORED BY: DARPA/TTO
Under Contract Number MDA903-79-C-0626

15

WARPA Order - 3830

DTIC
ELECTE

AUG 8 1980

A

The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies either expressed or implied of the Defense Advanced Research Projects Agency or the U.S. Government

DDC FILE COPY

New

411 876

DISTRIBUTION STATEMENT A

Approved for public release;
Distribution Unlimited

500 Macara Avenue • Sunnyvale, California 94086 • (408) 737-8000

80 6 24 035

System
Development
Corporation

500 MACAYA AVENUE • SUNNYVALE, CALIFORNIA 94086
TELEPHONE (408) 737-8000

16 June 1980
L-AA- 445

Director Advanced Research Projects Agency
1400 Wilson Boulevard
Arlington, Virginia 22209

Attention: CDR V. Simmons

Subject: Contract MDA903-79-C-0626^{ew}
Submittal of SDC Document

Gentlemen:

Attached for your review is SDC document TM-SV-5855/000/01,
"Software Interface Specification", dated 15 May 1980.

If you have any questions regarding the attached, please
contact Mr. Warren Iwamura at 415-968-9061, extension 233.

Sincerely,



J. P. Haverty
ARPA/ARC Program Manager

cc: DARPA
Dr. T. Kooij

ARC
Mr. E. L. Smith
Mr. C. Hoover

DDC
Camerson Station (2)

Defense Supply Service-Washington
Ms. J. Hensley

Data Depository
Mr. A. J. Rucker (2)

System Development Corporation

TM-SV-5855/000/01
15 May 1980

SOFTWARE INTERFACE SPECIFICATION

SUBMITTED BY:

WARREN IWAMURA

APPROVED BY:

Jim Rogers
Jim Rogers, Mgr. Systems Applications

Accession For	
NTIS GRA&I	<input checked="checked" type="checkbox"/>
DDC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
<i>Kittler on file</i>	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or special
A	

500 Macara Avenue • Sunnyvale, California 94086 • (408) 737-8000

TABLE OF CONTENTS

<u>SECTION</u>		<u>PAGE</u>
1.0	INTRODUCTION	1
2.0	ARC/DEPLOYED SENSOR SYSTEM OVERVIEW	2
3.0	SHORE BASED PROCESSOR CONTROL SYSTEM	6
3.1	INTER-PROCESSOR COMMUNICATION TASK	11
3.1.1	DATA DESCRIPTIVE DATA FORMATTER	11
3.1.2	TIME SERIES FORMATTER	40
3.1.3	DATA DESCRIPTIVE DATA UPDATE FORMATTER	46
3.2	GLOBAL COMMON AREA	61
4.0	INTER-PROCESSOR COMMUNICATION/DCS/KMC/NCP	66
5.0	UTILITY CONTROL SYSTEM (11/70)	66

LIST OF FIGURES

Figure 2-1	TOP LEVEL ARC/DS SYSTEM CONFIGURATION	3
Figure 2-2	TOP LEVEL ARC/DS SOFTWARE CONFIGURATION	5
Figure 3-1	INTERFACE PROCESSOR HARDWARE SCHEMATIC	7
Figure 3-2	SHORE BASED PROCESSOR CONTROL SOFTWARE INTERFACE	10
Figure 3-3	IPCT FLOW DIAGRAM	31
Figure 3-4	DATA DESCRIPTIVE DATA FORMATTER FLOW DIAGRAM	34
Figure 3-5	TIME SERIES DATA FORMATTER FLOW DIAGRAM	47

Figure 3-6	DATA DESCRIPTIVE DATA UPDATE FORMATTER FLOW DIAGRAM	57
------------	--	----

LIST OF TABLES

Table 3.1.2-1	ENVIRONMENTAL SENSOR TABLE	42
Table 3.1.2-2	ENVIRONMENTAL SENSOR COMMUNICATION	43
Table 3.1.3-1	PARAMETER CHANGE EVENTS	54
Table 3.1.3-2	SDCBFR DATA VALUES	55

1.0 INTRODUCTION

This document establishes the software interface between RCA's Shore Based Processor and Control System (SBPCS) software and the Acoustical Research Center Utility System Upgrade.

2.0 ARC/DEPLOYED SENSOR SYSTEM OVERVIEW

The shore based system configuration for the ARC/Deployed System experiment is illustrated in Figure 2-1. Data from two remote fixed sites is received through a satellite link by the Network Control Programs (NCP) which is a part of the Data Communication Subsystem (DCS) on the 11/70. Data from one or two buoys is initially received, through a satellite link, by the Shore Based Processor and Control System (SBPCS) on the 11/34. This data is processed and reformatted to an ARC standard format and passed to the NCP on the 11/70 via a KMC/DMC link.

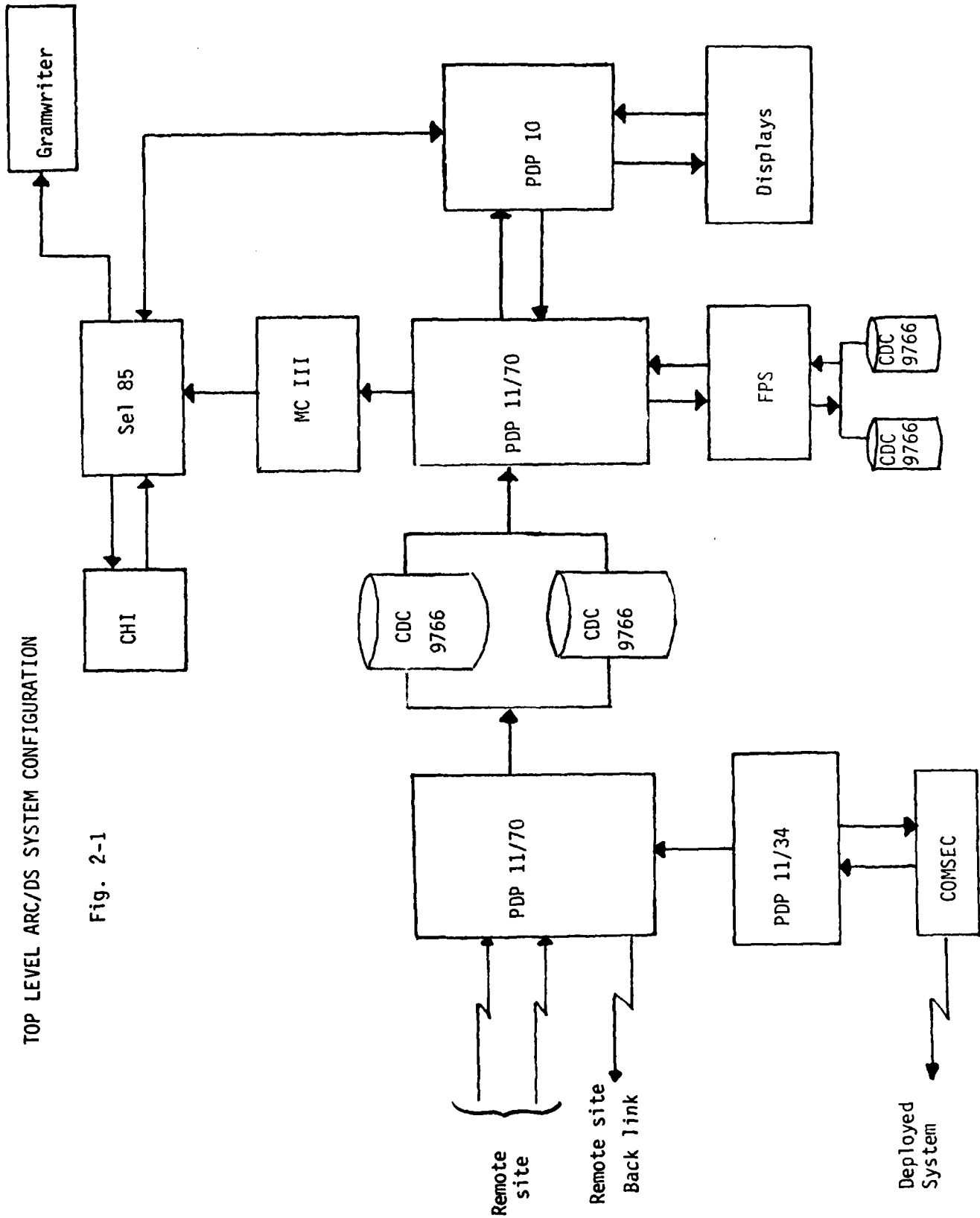
The Shore Based Processor and Control System provides the command and control, data reception and processing for the deployed arrays. The Inter-processor communication task provides the formatting of time series, Data Descriptive Data, and update messages. The Data Communication Subsystem (DCS) performs the protocol necessary to transmit the data through a KMC/DMC data path, which links the 11/34 and 11/70, to the Network Control Programs (NCP) on the 11/70. All data received by NCP is passed to the archiver to be placed on magnetic tape. NCP, by interpreting the data discriminator value in the header of each block of data, also passes the appropriate block of data to the Demultiplexer or the Spooler.

Data from the spool files is passed on request by Despooler to the Deployed System Gram Data Manager, the Correlation Task and the Array Orientation and Conditions Task. The Deployed System Gram Data Manager reformats selected channels of data into a MC III format and passes the data to the SEL Driver program for spooling. FFT's are performed on 10 channels of data on the CHI and displayed on the gramwriter.

The Array Orientation and Conditions Task use the spooled data to determine an estimation of the array orientation and rotational rate. The estimations are displayed and input on the 11/34 Deployed System Console. Array conditions data is also processed and retained in the Support Data Base and used to determine the cross beam patches for use by the Correlation Task.

TOP LEVEL ARC/DS SYSTEM CONFIGURATION

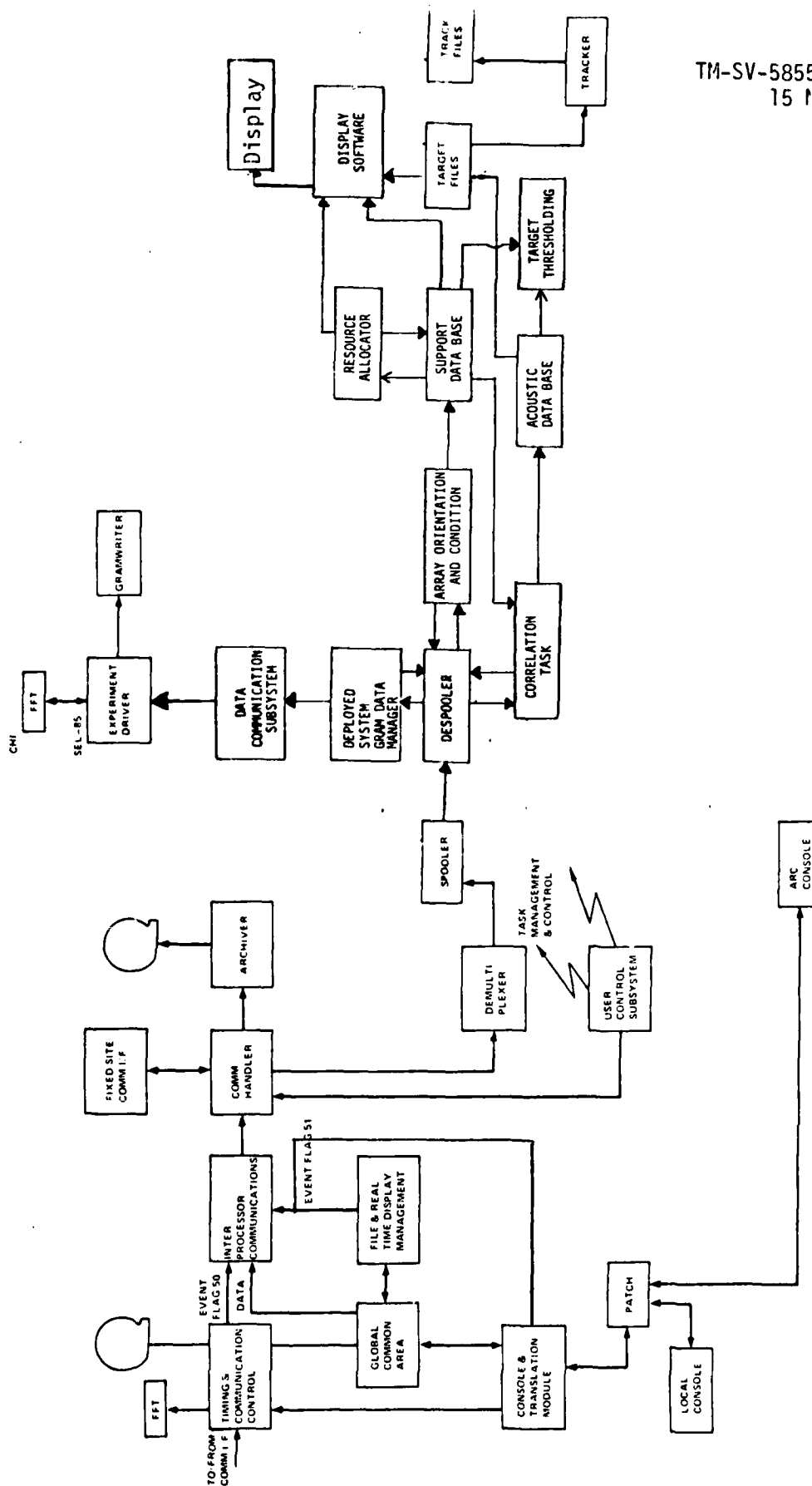
Fig. 2-1



The Correlation Task requests acoustical time series data from Despooler and generates correlation results using a FPS to be stored in the Acoustic Data Base for displays and input to the Target Threshold. The Tracker uses the thresholded data to establish a target track.

Figure 2-2 illustrates the Deploy System/ARC software configuration.

TM-SV-5855/000/01
15 May 1980



TOP LEVEL ARC/DS SOFTWARE CONFIGURATION

Figure 2-2

3.0 SHORE BASED PROCESSOR CONTROL SYSTEM

The Shore Based Processor Control System (SBPCS) consists of hardware and software to provide for the command and control, data reception, and data processing for the deployed arrays.

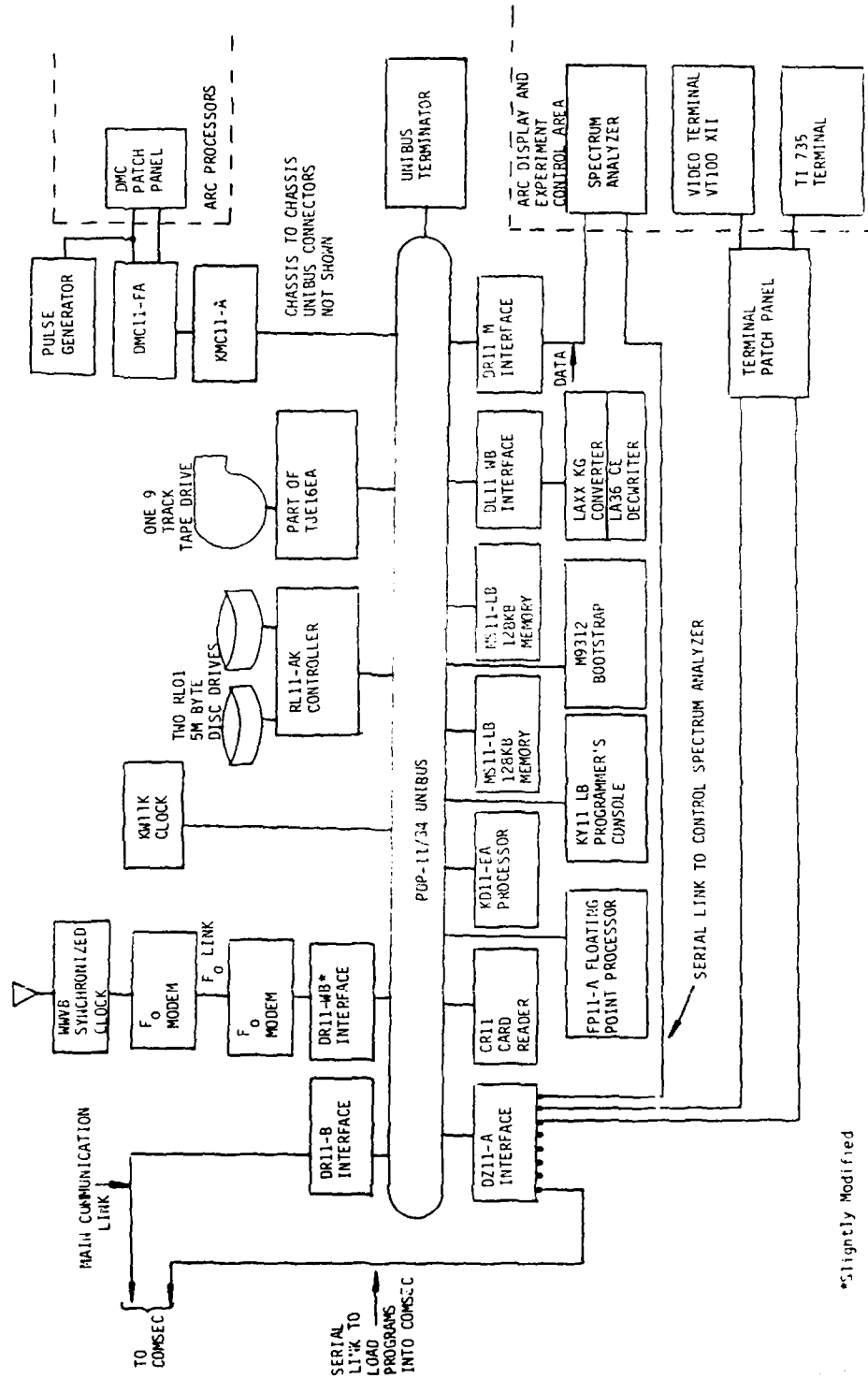
The hardware interface to the ARC consist of a simplex path from the 11/34 to the 11/70. This path is used to transmit formatted time series data, Data Descriptive Data (D^3), and update messages. Figure 3-1 illustrates the hardware interface configuration.

The SBPCS software support on the 11/34 consist of seven major tasks: Initialization File Edit, Initialization, Timing and Communication Control, File and Real-Time Display Management, Console and Translation, Interprocessor Communication, and Playback.

The Initialization File Edit task is an off-line task which is used to create and edit various disk files which are used as input to the Initialization task for establishing default conditions and initializing tables in memory. These initialization files may be deleted, recreated, or edited at any time the real-time Operational System is not executing. In this way, the operator will be capable of tailoring his system to particular buoy configurations without the need to change software.

The Initialization task provides the operations necessary to initiate the system software resident in the PDP 11/34 Shore Based Processor and Control Station. This task is divided into a control module and three functional modules: WWVB Time Base, Initialize 11/34 Operational System and COMSEC STE Load. The WWVB Time Base module (WWI) assures accurate inter-system timing. The 11/34 Operational System Initialization module (INI) initiates into operation all functions of the 11/34 operational software. The COMSEC STE Load module (CMI) initializes the COMSEC STE which controls the COMSEC Sub-assembly and the Satellite Ground Station Communications terminal.

FIGURE 3-1: SHORE BASED INTERFACE PROCESSOR HARDWARE SCHEMATIC



*Slightly Modified

The Timing and Communications Control task (TCCT) controls the real-time communications and processing functions for the 11/34 operational system. Command and reply message processing are controlled within the task. The reply messages are archived and demultiplexed then further processed by the FFT. The filter quantization level is also controlled within this task. The task is divided into a control module (TCCT) and five functional modules as follows: COMSEC STE I/O Interface (CIT), Tape Archiver (TAT), Demultiplexer (DXT), Quantization Control (QCT) and FFT Driver (FTT).

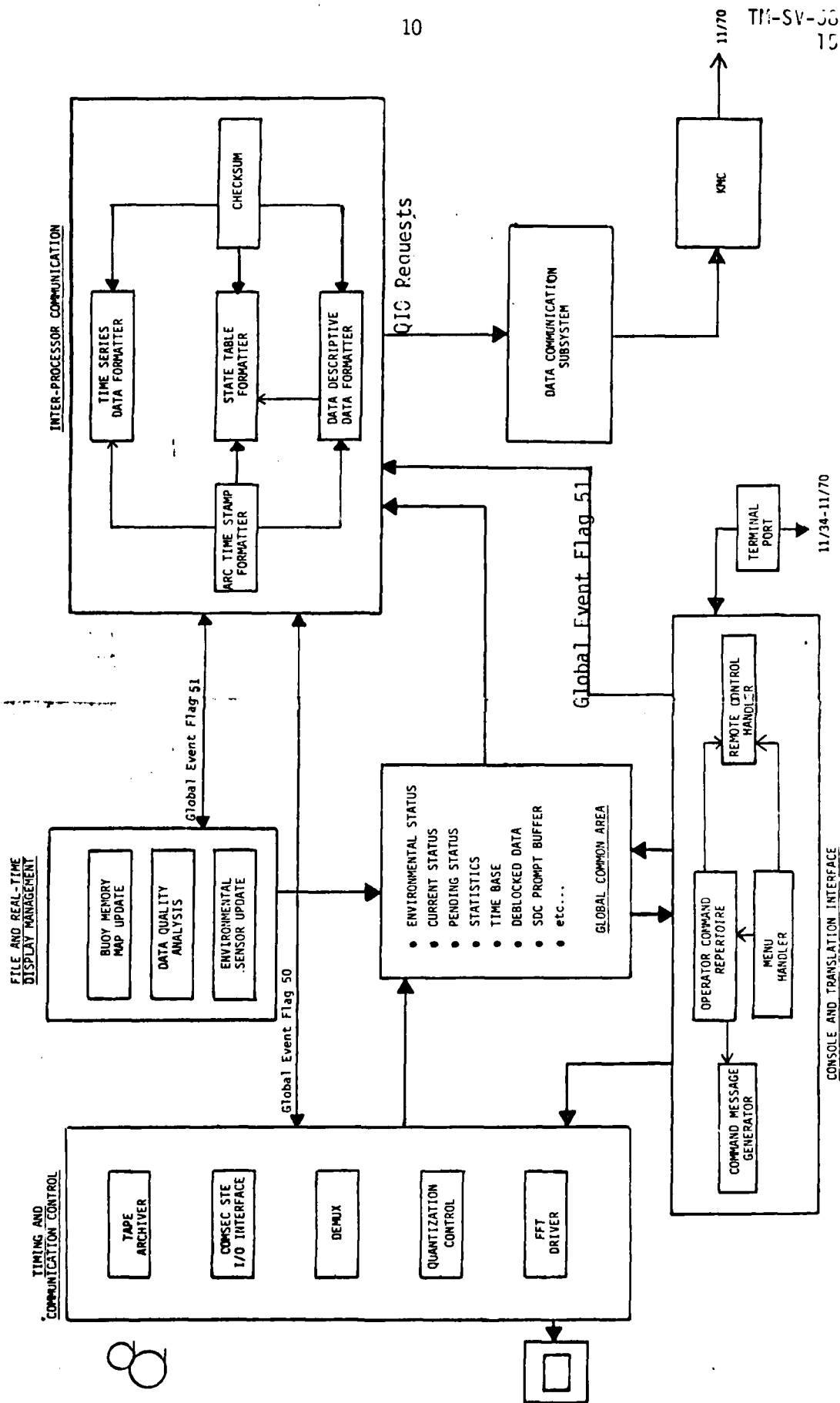
The File and Real-Time Display Management task (FRTD) continuously supplies system status to the operator while updating buoy configuration files, tables, and maps as changes are implemented. This task is initiated by a global event flag, #42 sent from the Timing and Communications control task after tape archive processing has terminated. This task consist of a control module and four functional modules as follows: Data Quality Analysis (DQF), Current Status (CSF), Environmental Sensors (ESF), and Buoy Memory Maps (BMF).

The Console and Translation Interface task (CTIT) provides for an interactive interface with the system operator to permit him to monitor and control the D.S. Operating System. This task is asynchronous within the D.S. Operating System and is divided into a control module and three functional modules as follows: Menu Handler, Operator Command Repertoire, and the Command Message Generation.

The Inter-processor Communication Task (IPCT) reformats processed data resident in the Global Common Area into an ARC standard format and passes the messages to the 11/70. The Data Descriptive Data messages are passed to the 11/70 at the initialization of this task and whenever a buoy is activated. ARC acoustic time series data messages are created from data in Global Common array BBBUF and passed to the 11/70 whenever the Demultiplexer function sets global event flag 50. This event flag also prompts IPCT to create a non-acoustic time series data message from environmental sensor data in the

Global Common Area. This message contains 30 seconds of environmental data. The File and Real-Time Display Management task will prompt IPCT with global event flag 51 whenever there is a parameter change affected in a buoy. Global Common array SDCBFC will contain the necessary information in order for IPCT to generate the necessary D^3 update message to communicate the change to the back-end processes. D^3 update messages are generated for changes to Basic Data Descriptive Data or Experiment Specific D^3 . Figure 3-2 illustrates the interrelation of tasks in the PDP 11/34.

The Playback task performs the simulation of the D.S. operational system. This task will not be utilized during real-time buoy applications since it strictly performs a support role for D.S. This task replaces the Timing and Communications Control task of the real-time operating system. The operator initiates this playback operation mode during initialization. The archived tape previously generated on the PDP 11/34 during real-time buoy control applications serves as input to the simulator. This task is divided into a controlling module (PLAY) and three functional modules as follows: Real-Time Tape Dearchiver (TDP), Demultiplexer (DXT), FFT Driver (FTT).


 SHORE BASED PROCESSOR CONTROL SOFTWARE INTERFACE
 Figure 3-2

3.1 INTER-PROCESSOR COMMUNICATION TASK

The inter-processor communication task consists of three major functions:

- Data Description Data
- Time Series Data Formatter
- Data Descriptive Data Update Formatter

Figure 3-3 illustrates the functional flow of the Inter-Processor Communication Task. At initialization of the software system on the 11/34, the IPCT generates Data Descriptive Data (D^3) messages for each buoy and passes the information to the 11/70. The system directive WTLO is called to put the IPCT to sleep until global event flags 49, 50, or 51 are set. Event flag 49 is set by the directive MARK when 3 seconds have elapsed, causing the IPCT to generate a No-op message to the 11/70 Data Communications Subsystem. Global event flag 51 signals the occurrence of an event that requires the generation of Data Descriptive Update Data Message. Global event flag 50 signals to IPCT that data has been demultiplexed and placed in array BBBUF, and that an environmental sensor value was received. The Time Series Data formatter is called to generate time series data messages in the ARC format for transmission to the 11/70. The data required for the generation of the messages are contained in the Global Common Area. Subroutines ARCTIME and CKSUM are called by functions to determine the ARC time stamp and checksum values.

3.1.1 Data Descriptive Data Formatter

Basic Data Descriptive Data (BD^3) and Experiment Specific Data Descriptive Data (ESD^3) messages are created by this function from variables in the Global Common Area (GCA) at the initialization of the IPCT task and whenever a buoy is activated (see figure 3-4). Each buoy is treated as a unique data source and the data values plus some header information of each message is retained in a BD^3 file and ESD^3 file on the 11/70. Any changes to these data values are communicated via a D^3 Update message. The current time tag associated with each message is contained in Global Common array TIME. TIME is a five integer word array expressing time in day, hours, minutes, seconds, and milliseconds. Subroutine ARCTIME is called to convert TIME into ARC microseconds. Checksum values in the ARC header are determined by subroutine CKSUM.

The Global Common Area values that are accessed by this function are as follows:

- | | |
|------------|------------|
| ● ACHDG1/2 | ● ICQTZ1/2 |
| ● ACTAZ1/2 | ● ICTAP1/2 |
| ● CFREQ1/2 | ● IHYDR1/2 |
| ● FIR11/2 | ● IQCS1/2 |
| ● FIR21/2 | ● LOCAT1/2 |
| ● FIR31/2 | ● SHAD1/2 |
| ● HEADG1/2 | ● SLAT |
| ● IACFG1/2 | ● SLONG |
| ● IADCL1/2 | ● TIME |
| ● IBEAM1/2 | |

The BD³ file is to contain unique beam identifiers for each Deployed Sensor beam. These unique beam numbers are determined by taking the absolute value of the actual azimuth minus the heading (the heading value used is dependent on the mode of operation) to produce a beam angle relative to the array. This angle is then inserted into the following equation to produce the unique beam identifier.

$$\text{Unique I.D.} = \text{INT} (n * (1.0 + \cos (\pi/180. * AZ)))$$

where AZ is the beam angle relative to the array and n is a constant.

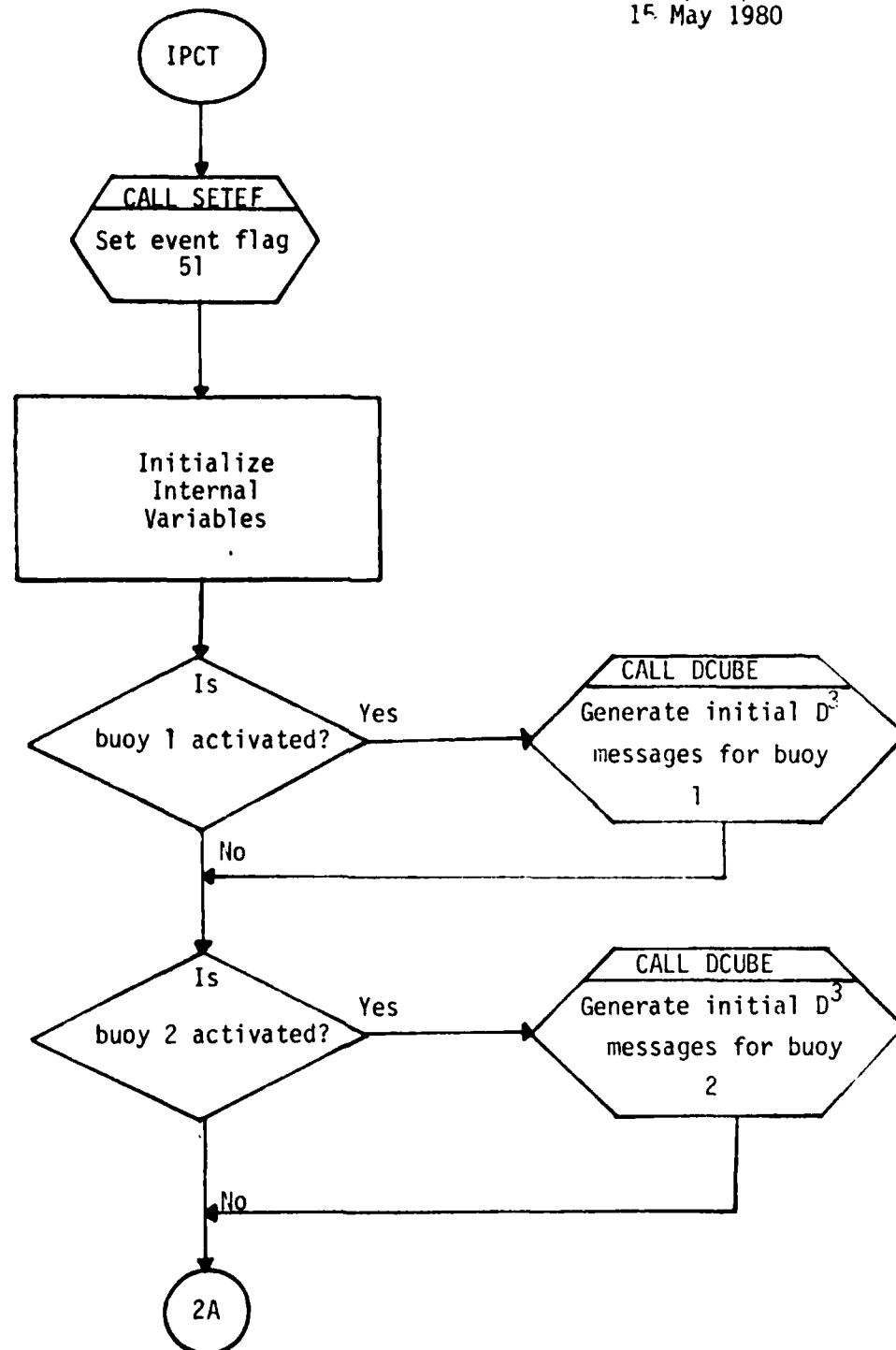
The Basic Data Descriptive Data message contains the ARC headers plus the current time in the header with the following items as the data set in the message:

- | | |
|---|--|
| ● Unique beam numbers relative to the array | - Thirty integer values containing the unique beam number relative to the array. The designated hydrophone will be indicated in this array by a unique identifier. |
| ● Psuedo array number | - Thirty integer values containing a pseudo array number for each buoy. |

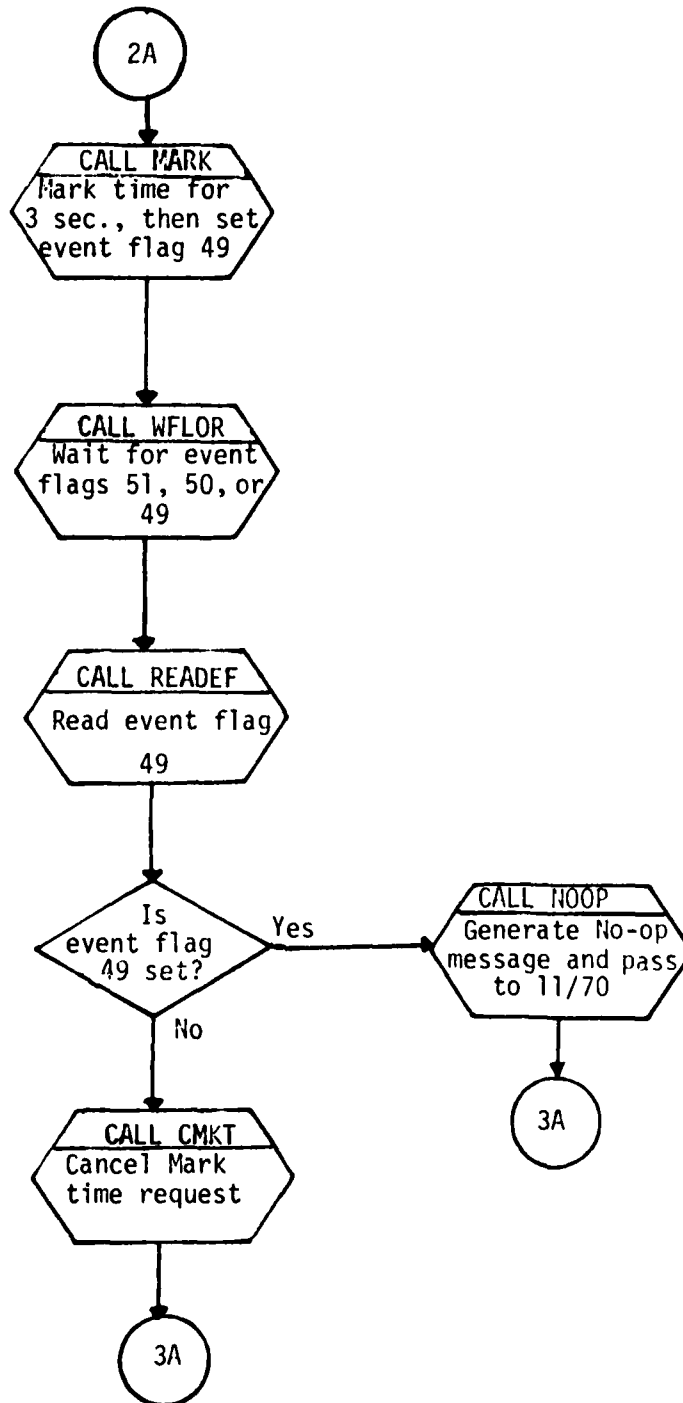
- Center frequency for each beam band
 - Thirty pairs of 16 bit integer words of the center frequency for each beam band pair. The first word in each pair expresses the center frequency in integer hertz and the second word expresses the fractional part in milli-hertz.
- Bandwidth for each beam band
 - Thirty pairs of 16 bit integer words of the filter bandwidth for each beam band pair. The first word in each pair expresses the bandwidth in integer hertz and the second word expresses the fractional part in milli-hertz.

The Experiment Specific Data Description Data message contains the ARC headers plus the current time tag in the header with the following items as the data set in the message:

- Current beam number for each band
 - Thirty 16 bit integer containing the ATMAC beam number (1-10) associated with each beam band. If a hydrophone is assigned to a beam band pair, the beam number will be set to zero for that entry.
- Quantization level for each beam band
 - Thirty 16 bit values containing the output quantization level applied to each beam band. The upper byte contains the least significant bit position and the lower byte contains the number of bits.
- Quantization control flag
 - One 16 bit flag indicating whether the quantization level was input by the operator or automatically by the 11/34 software.
- Shading coefficients
 - Twenty-seven 16 bit integer values.
- First stage filter coefficients
 - Nineteen 16 bit integer values.
- Second stage filter coefficients
 - Seventeen 16 bit integer values.
- Third-sixth stage filter coefficients
 - Twenty-one 16 bit integer values.

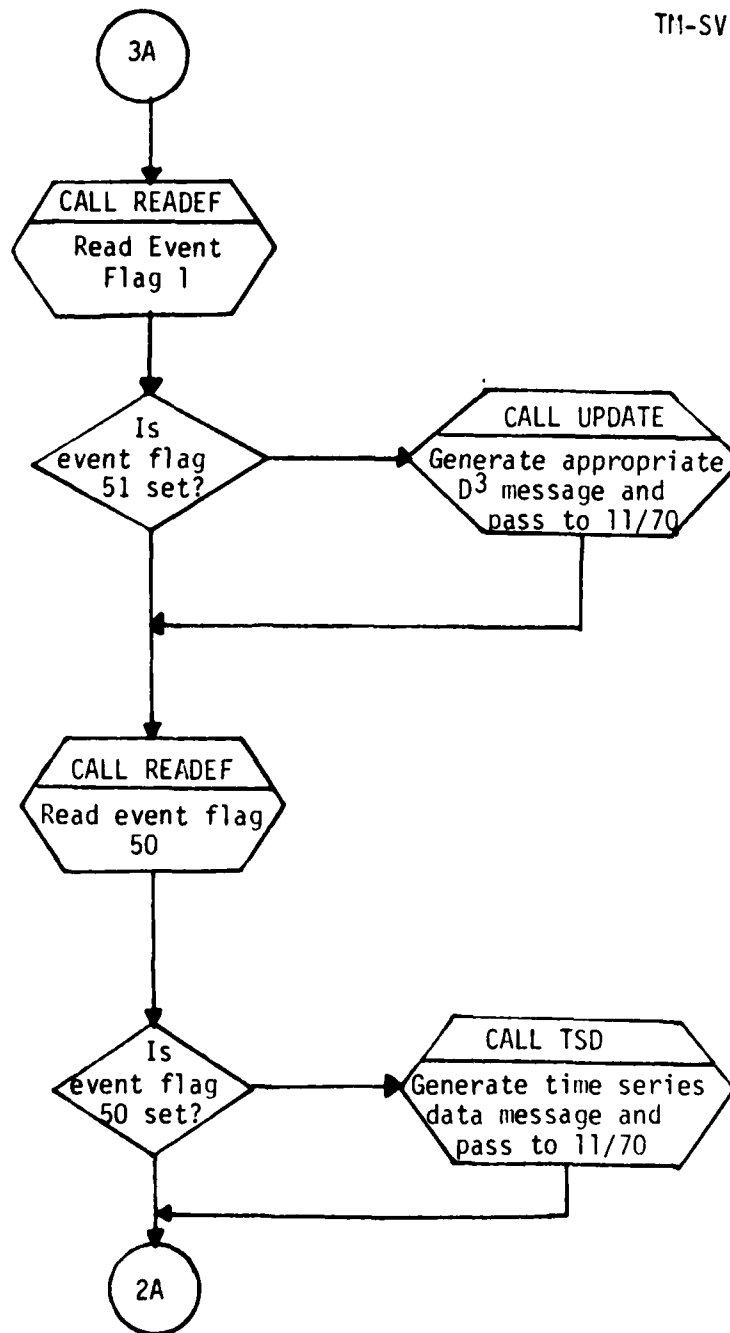


IPCT Flow Diagram



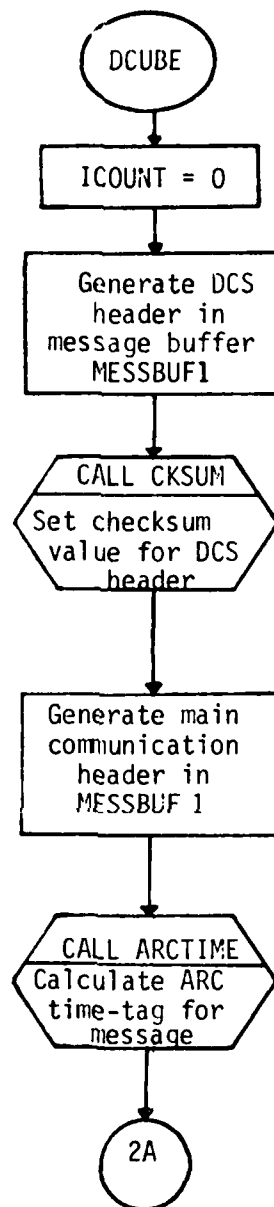
IPCT FLOW DIAGRAM

Fig. 3-3



IPCT FLOW DIAGRAM

Fig. 3-3
(Page 3 of 3)



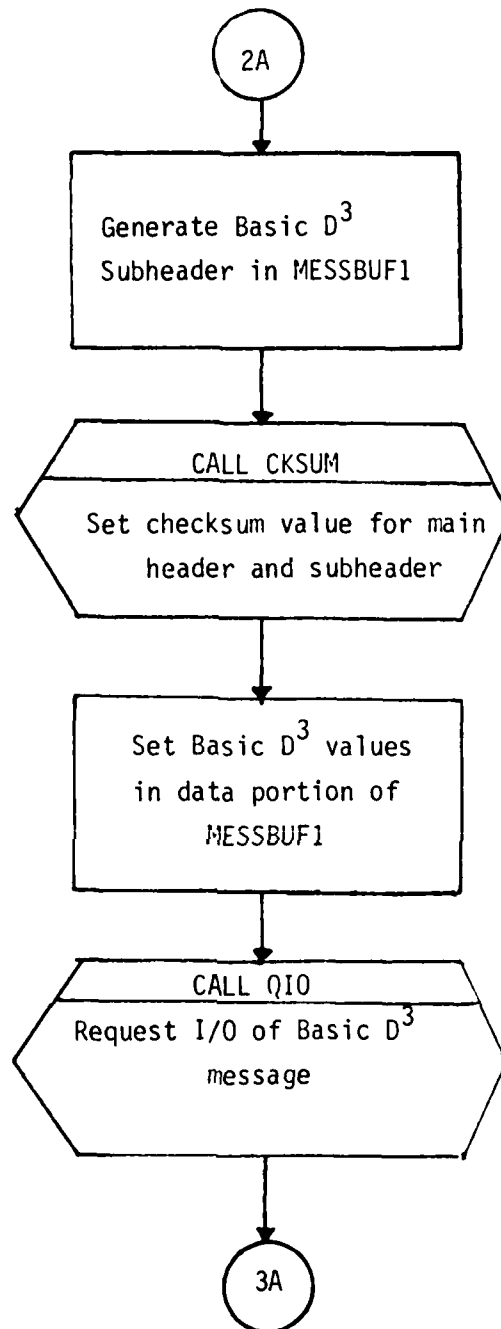
DATA DESCRIPTIVE DATA FORMATTER

FLOW DIAGRAM

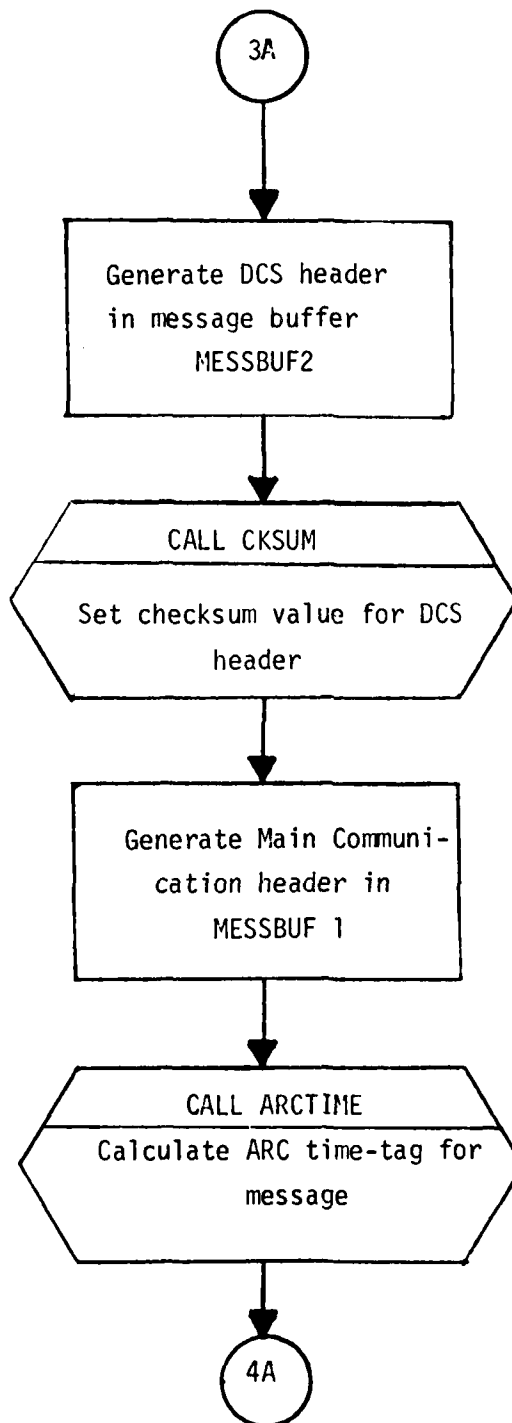
Figure 3-4

(Page 1 of 6)

15 May 1980



DATA DESCRIPTION DATA FORMATTER
FLOW DIAGRAM
Figure 3-4
(Page 2 of 6)

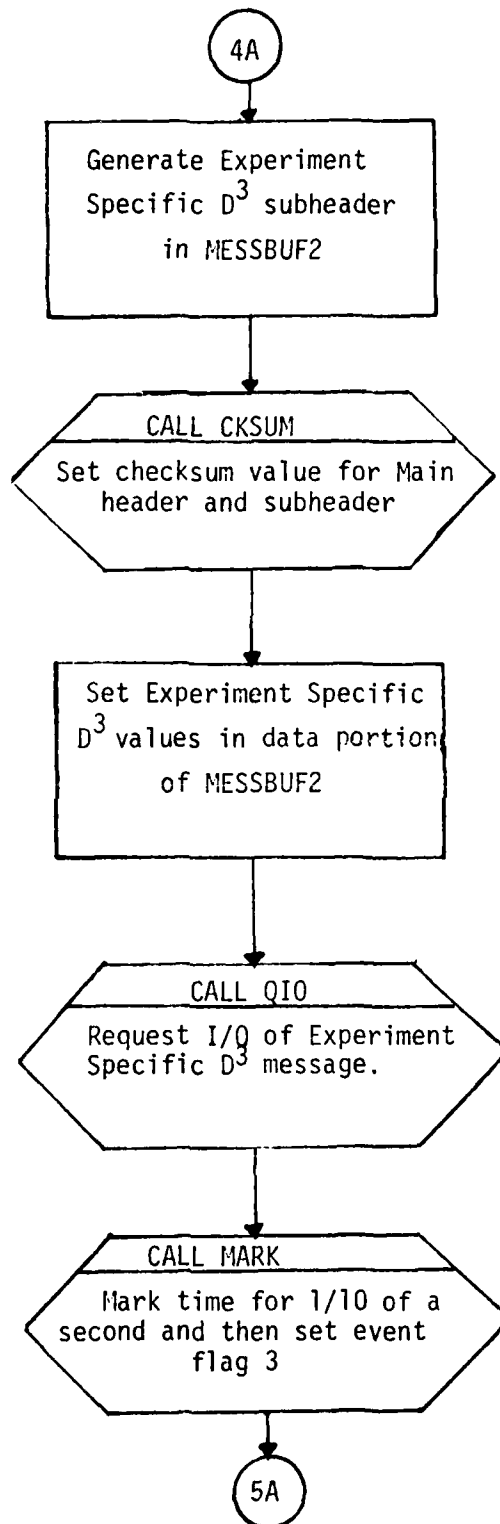


DATA DESCRIPTIVE DATA FORMATTER

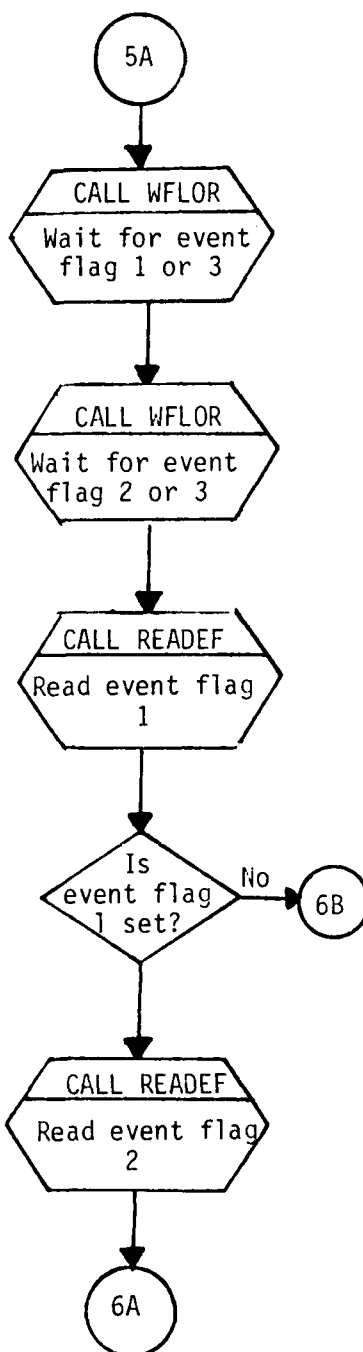
FLOW DIAGRAM

Fig. 3-4

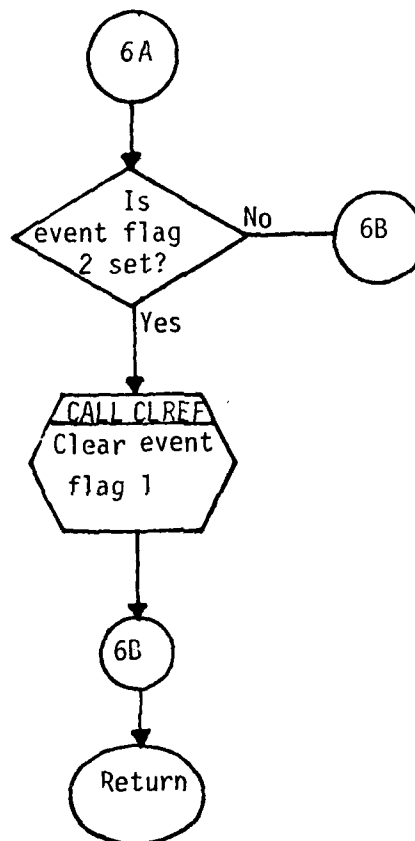
(Page 3 of 6)



DATA DESCRIPTIVE FORMATTER
FLOW DIAGRAM



DATA DESCRIPTIVE DATA FORMATTER
FLOW DIAGRAM
Figure 3-4
(Page 5 of 6)



DATA DESCRIPTION DATA FORMATTER
FLOW DIAGRAM

Fig. 3-4

(Page 6 of 6)

- A/D control word
 - One 16 bit word with the upper four bits specifying the gain in 3 db counts and the lower three bits specifying the code value for the quantization level. A value of 15 for the gain signals the ATMIC to determine the gain. The quantization level values range from 0-4 and imply 8-4 bits respectively.
- Satellite latitude
 - Two 16 bit integer words with the first word containing integer degrees and the second word containing the fractional part in ten thousandths of a degree.
- Satellite longitude
 - Two 16 bit integer words with the first word containing integer degrees and the second word containing the fractional part in ten thousandths of a degree.
- Hydrophone number
 - One 16 bit integer indicating the designed reference hydrophone (1-53).
- Hydrophone shading value
 - One 16 bit integer containing the shading coefficient value used in processing the hydrophone data.
- Locator
 - 16 bit word ASCII value with "SN" indicating SATNAV fix and "LC" indicating Loran C.

As a signal to the RCA tasks, global event flag 51 will be cleared when this function completes its reformatting and transmission of the messages.

3.1.2 Time Series Data Formatter

The Time Series Data Formatter (see Figure 3-5) generates non-acoustic time series messages for the environmental sensor values and the AGC gain and acoustic time series data message (see Appendix A) and passes it to the 11/70.

Acoustic Time series data is deblocked and placed in array BBBUF in the PDP-11/34 by the RCA software. Each beam band is column oriented in this array.

The Inter-Processor Communication task is prompted by the setting of global event flag 50 by the Demultiplexer function on every message cycle, whether a reply message was received or not received. The Global Common Area values that are accessed by this function are as follows:

- | | |
|------------|------------|
| ● ACAZR1/2 | ● IDMXFG |
| ● ACBER1/2 | ● IGAIN1/2 |
| ● ACHDG1/2 | ● ISEQ1/2 |
| ● ACTAZ2/2 | ● LOCK11/2 |
| ● AZRTE2/2 | ● LOCK21/2 |
| ● BBBUF | ● LOCK31/2 |
| ● CBLAT1/2 | ● PRSR11/2 |
| ● CBLNG1/2 | ● PRSR21/2 |
| ● COMPS1/2 | ● PRSR31/2 |
| ● HEADG1/2 | ● SIGSQ1/2 |
| ● IACFG1/2 | ● TENSNI/2 |
| ● IBEAM1/2 | ● TIMX |
| ● IDBID | |

When global event flag 50 is sensed by this function, it will first check the environmental sequence number (ISEQ1/2) to see if it is set to 1 or 69 which indicates a compass update or only a acoustic bearing update. In this case, this function will format a non-acoustic time series data message with appropriate ARC headers and time tag. The time-tag will be determined by calling ARCTIME with global common array TIMX as an input and checksum values are determined by calling subroutine CKSUM.

If the sequence number is not 1 or 69, the environmental sensor value indicated by the sequence number (see Table 3.1.2-1) will be stored internally. This implies that 30 seconds (for each buoy) of environmental sensor data will be stored before a non-acoustic time series message is generated. The time-tag associated with the message would correspond to time of the expected compass value. Since the sensors are commutated (see Table 3.1.2-2) the time-tag of each (two) sensor received can be easily determined. Sensor values not received in the 30 second period will be initialized to a minus one value.

<u>Sequence code</u> <u>(ISEQ1/2)</u>	<u>Sensor Value</u>
0	No sensor update
1	Tug compass
2	Pressure sensor #1
3	Pressure sensor #2
4	Pressure sensor #3
5	Tension sensor
6	Lock Status (bits 1-11)
7	Lock Status (bits 12-22)
8	Lock Status (bits 23-32)
9	Sigma squared
10	Buoy latitude
11	Buoy longitude
69	Only acoustic bearing update

ENVIRONMENTAL SENSOR TABLE

Table 3.1.2-1

Tug Compass

Pressure Sensor 1

Pressure Sensor 2

Tug Compass

Pressure Sensor 3

Tension Sensor

Tug Compass

Lock Status 1

Lock Status 2

Tug Compass

Lock Status 3

Sigma Squared

Tug Compass

Buoy Latitude

Buoy Longitude

ENVIRONMENTAL SENSOR COMMUTATION

Table 3.1.2-2

The data portion of the non-acoustic time series data message will contain the following values.

- Compass - 16 bit unsigned integer in hundredths of degrees.
- Pressure 1 - 16 bit integer in tenths of a meter
- Pressure 2 - 16 bit integer in tenths of a meter
- Pressure 3 - 16 bit integer in tenths of a meter
- Tension - 16 bit integer in tenths of a pound
- Lock Status 1 - 16 bit word with the 11 least significant bits indicating the functional state of the hydrophone multiplex channels 1-11.
- Lock Status 2 - 16 bit word with the 11 least significant bits indicating the functional state of hydrophone multiplex channels 12-22.
- Lock Status 3 - 16 bit word with the 10 least significant bits indicating functional state of the hydrophone multiplex channels 23-27 and environmental sensors for pressure 1-3, tension, and compass.
- Sigma Squared - 16 bit integer containing the variance of the input hydrophone data.
- Buoy Latitude - Two 16 bit integer words with the first word containing integer degrees and the second word containing the fractional part in ten thousandths of a degree.
- Buoy Longitude - Two 16 bit integer words with the first word containing integer degrees and the second word containing the fractional part in ten thousandths of a degree.
- Gain - Three 16 bit integer words containing the gain value. Gain is received every 10 seconds (every message) for each buoy. The third gain value is associated with the current time. In order to determine if the gain value was determined by the ATMAC or a shore operator, one must interpret the A/D control word.

- Current azimuth for each beam band - Thirty 16 bit unsigned integer values expressed in hundredths of degrees with respect to true north. Updated at the same time compass value received and/or estimated bearing is updated.
- Current beam number for each beam band - Thirty 16 bit integer values giving the ATMAC beam number (1-10) associated with each beam band. If a hydrophone is assigned to a beam-band pair, the beam number will be set to zero for that entry.
- Heading used flag - 16 bit integer word indicating whether the tug compass or the estimated heading is currently being used to determine the current azimuth values.
- Estimated heading - 16 bit unsigned integer in hundredths of degrees. Estimated orientation of array with respect to true north.
- Compass heading - 16 bit unsigned integer in hundredths of degrees. Orientation of array, as determined from the tug compass, with respect to true north.
- Estimated rotation rate - 16 bit signed integer in thousandths of a degree/minute. Rotation rate estimated by PDP-10 software.
- Compass rotation rate - 16 bit signed integer in thousandths of a degree/minute. Rotation rate determined with the last two compass values.
- Estimated bearing - 16 bit unsigned integer in hundredths of degrees. Estimated array orientation with respect to magnetic north.

Once the environmental sensor value and the AGC gain value has been transmitted to the 11/70, the demultiplexed time series data in BBBUF are retrieved and ARC headers are affixed to each beam band block of data for transmission to the 11/70. Each block of data contains ten seconds of data, but the number of samples in each block is dependent on the filter bandwidth of the selected beam band pair. Each beam band pair is given a corresponding channel number in the generated ARC header which implies a separate data spool on the 11/70 for each beam band pair. If the collection configuration changes, these same

data spools are used to spool the data. The time stamp associated with each beam band is determined by taking the base time in the Global Common Area (TIMX) and calling ARCTIME. Checksum values in the header are determined by calling subroutine CKSUM.

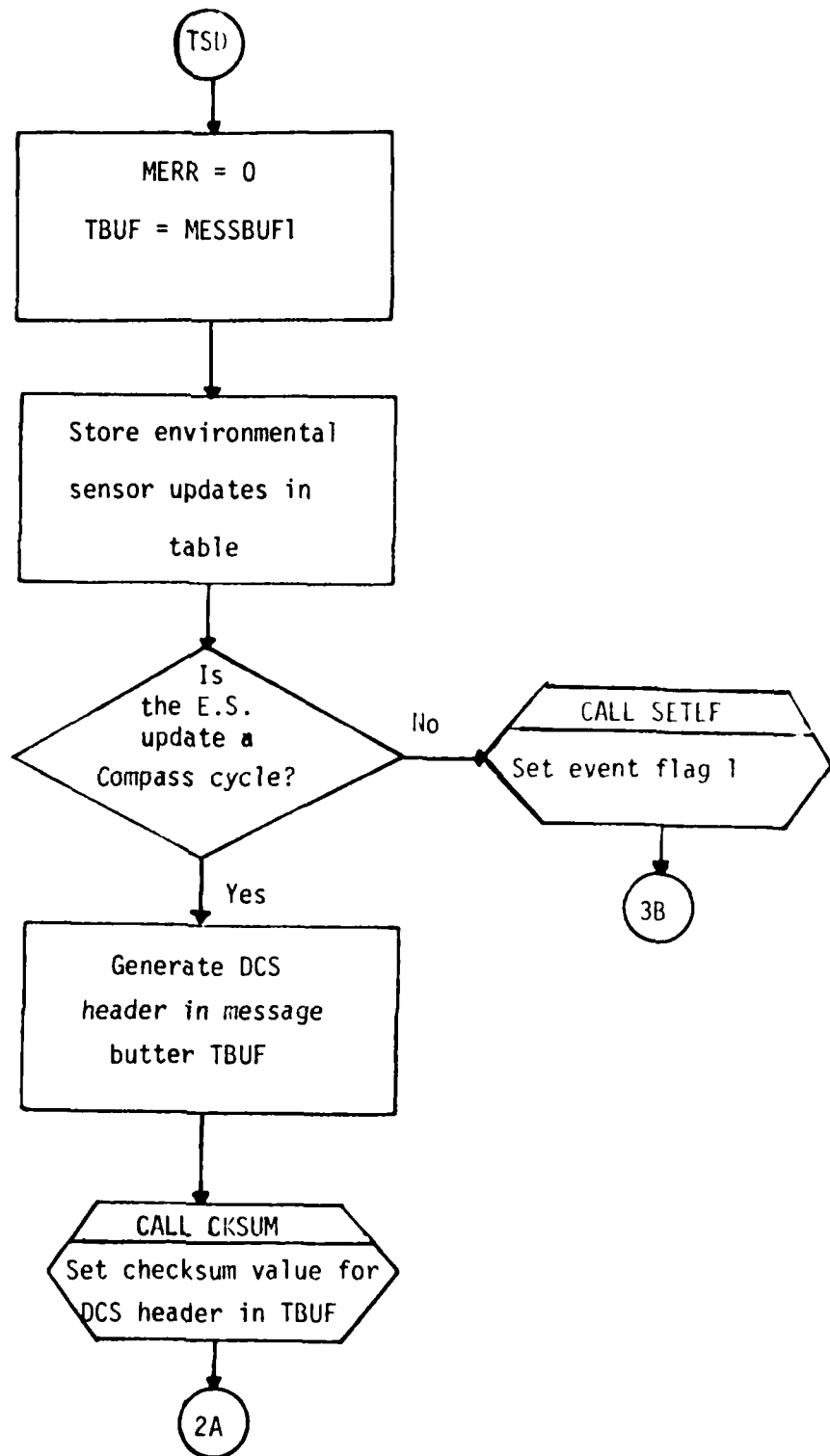
There are two internal buffer areas for building the ARC time series data block. As one block of data is being passed to the DCS I/O driver, the task will process the next block of data in the second buffer space. Once all the data has been passed to the 11/70, the Inter-Processor Communication task will clear Global Event flag 50 to signal its completion.

3.1.3 Data Descriptive Data Update Formatter

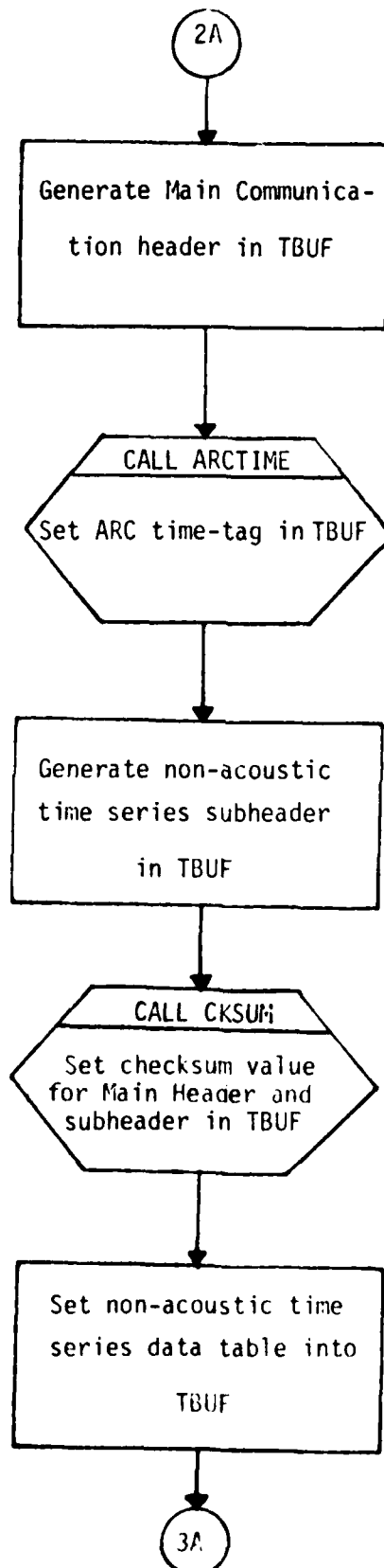
The Data Descriptive Data Update Formatter (see Figure 3-6) generates update messages (see Appendix A) whenever there is a change to Basic Data Descriptive Data, Experiment Specific Data Descriptive Data, or the continuity of time series data. The File and Real-time Display Management task will prompt, via global event flag 51, the Inter-Processor Communication task of a D³ event and pass the information of the variables affected and their new value in Global Common array SDCBFR. The first three words of SDCBFR are equivalenced to IBYID, IERROR, and IEVENT. IBYID contains the buoy number (1 or 2) for which the prompt occurred. IERROR indicates the quality of the time series data. IERROR equal to 18 indicates that some of the samples are corrupted and IERROR equal to 19 indicates all samples are corrupted in the reply message. IEVENT communicates the type of change associated with the prompt (see Table 3.1.3-1). The remaining words in SDCBFR contain the new values of the changed group (see Table 3.1.3-2). The time-tag associated with the change and/or the corrupted data is contained in the Global Common array TIME.

The Global Common Area values that are accessed by this function are as follows:

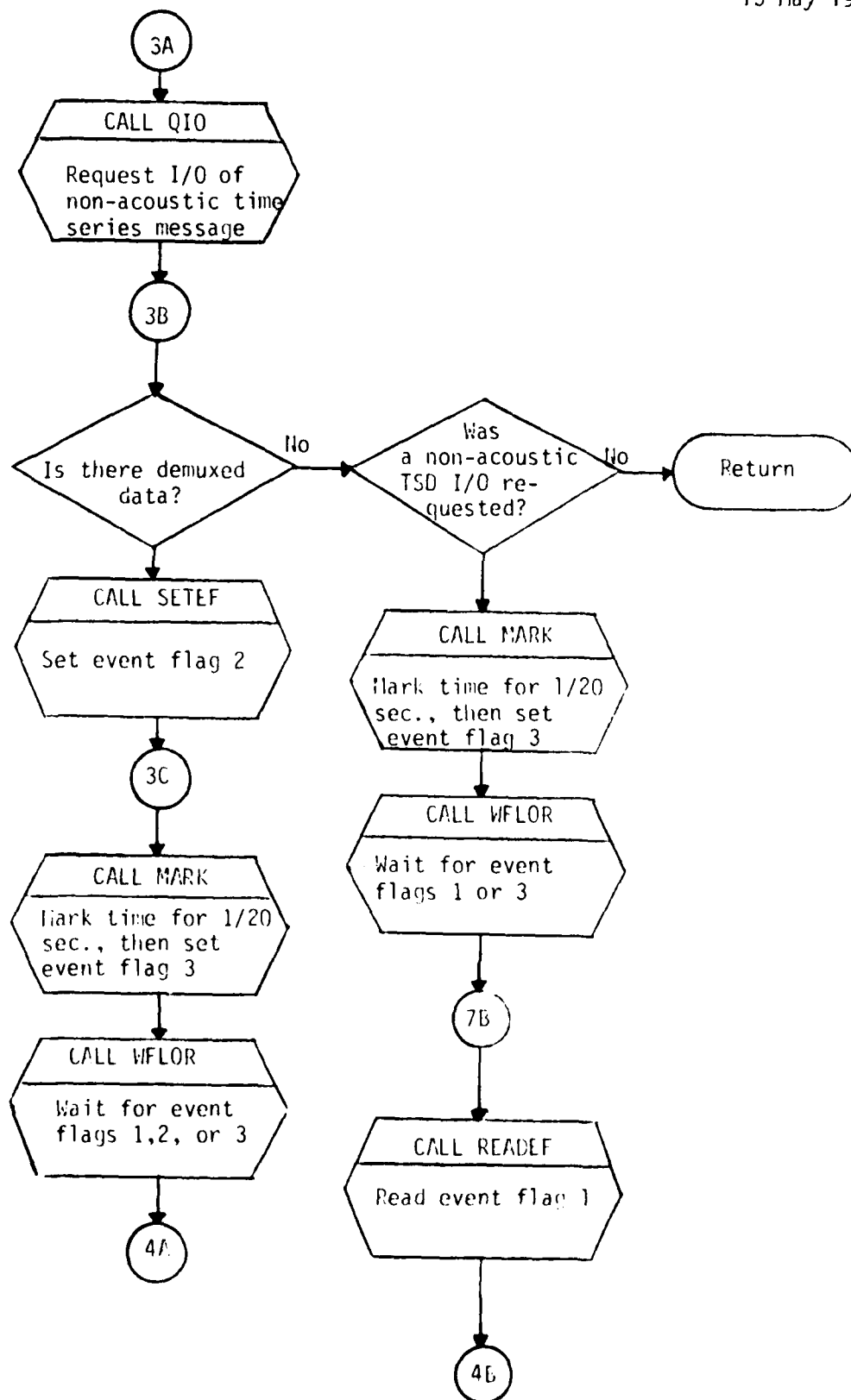
- | | |
|------------|------------|
| ● ACHDG1/2 | ● IERROR |
| ● ACTAZ1/2 | ● IEVENT |
| ● HEADG1/2 | ● IQCS1/2 |
| ● IACFG1/2 | ● LOCAT1/2 |
| ● IACTV1/2 | ● SDCBFR |
| ● IBYID | ● TIME |
| ● ICTAP1/2 | |



TIME SERIES DATA FORMATTER FLOW DIAGRAM



TIME SERIES DATA FORMATTER
FLOW DIAGRAM
Figure 3-5
(Page 2 of 7)

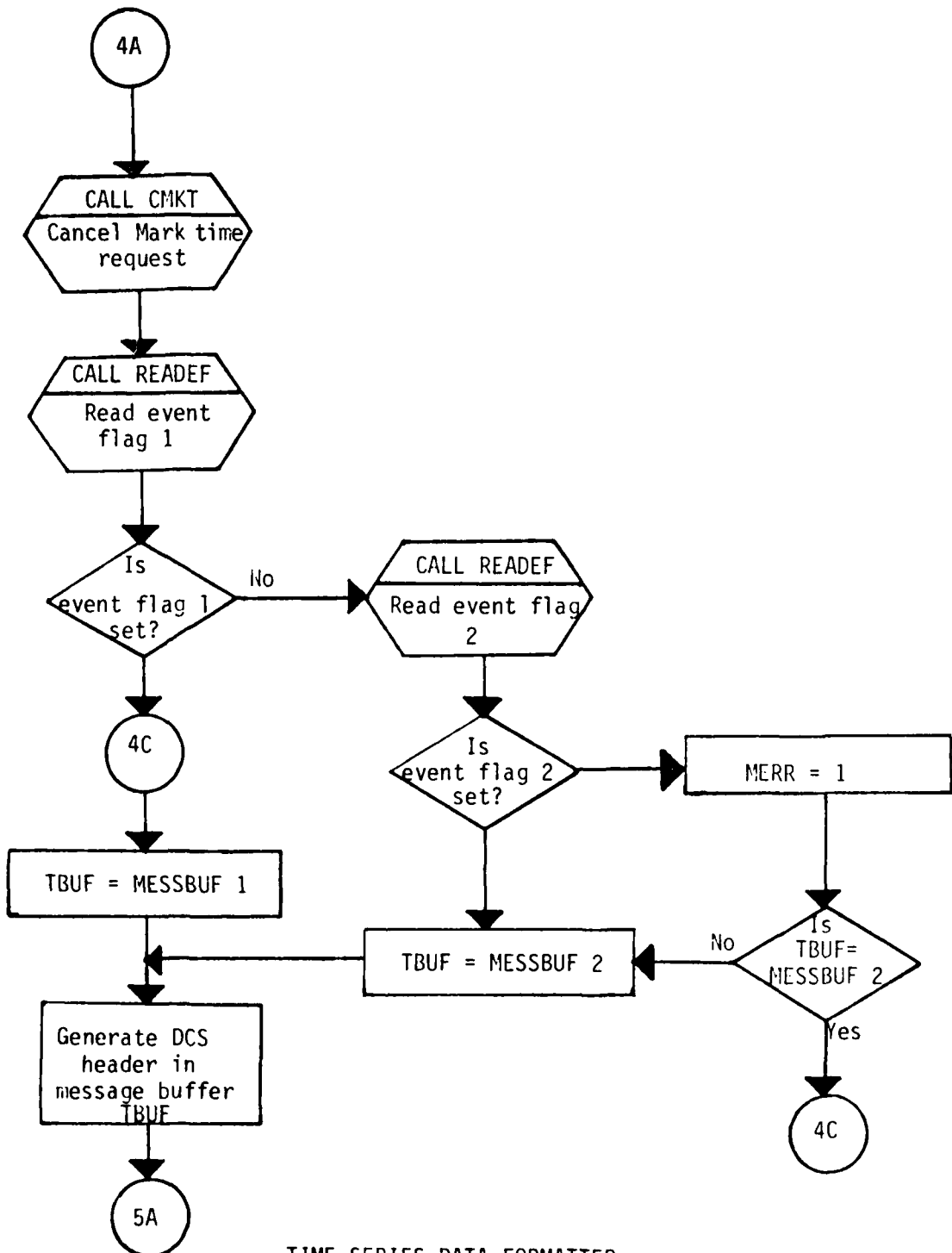


TIME SERIES DATA FORMATTER

FLOW DIAGRAM

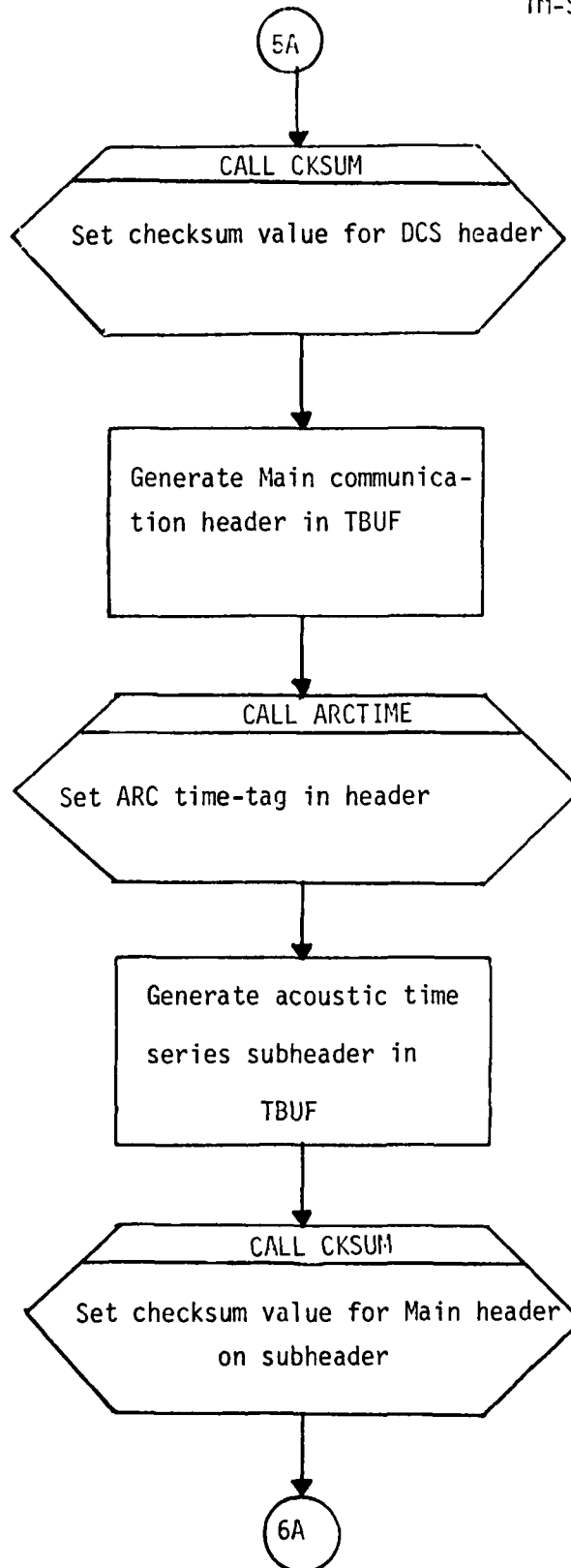
Figure 3-5

(Page 3 of 7)



TIME SERIES DATA FORMATTER
FLOW DIAGRAM

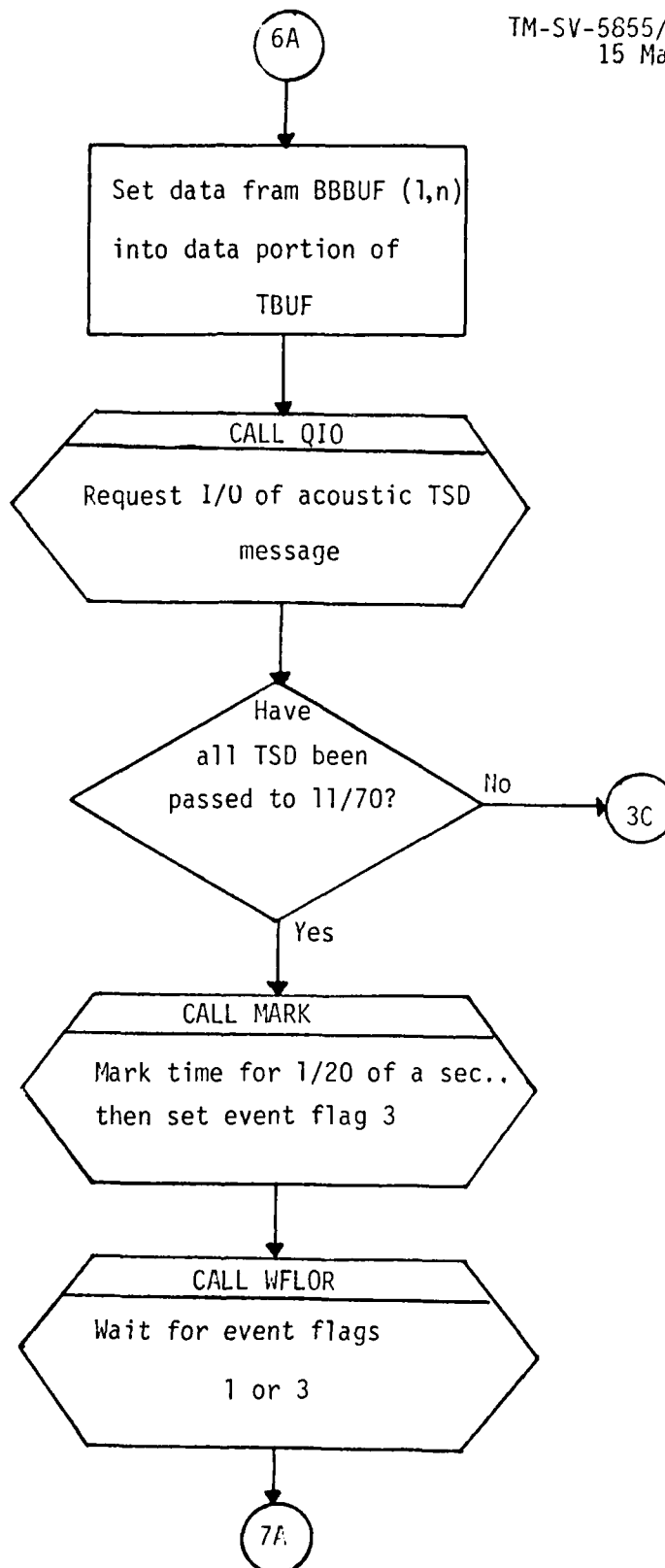
Figure 3-5
(Page 4 of 7)



TIME SERIES DATA FORMATTER

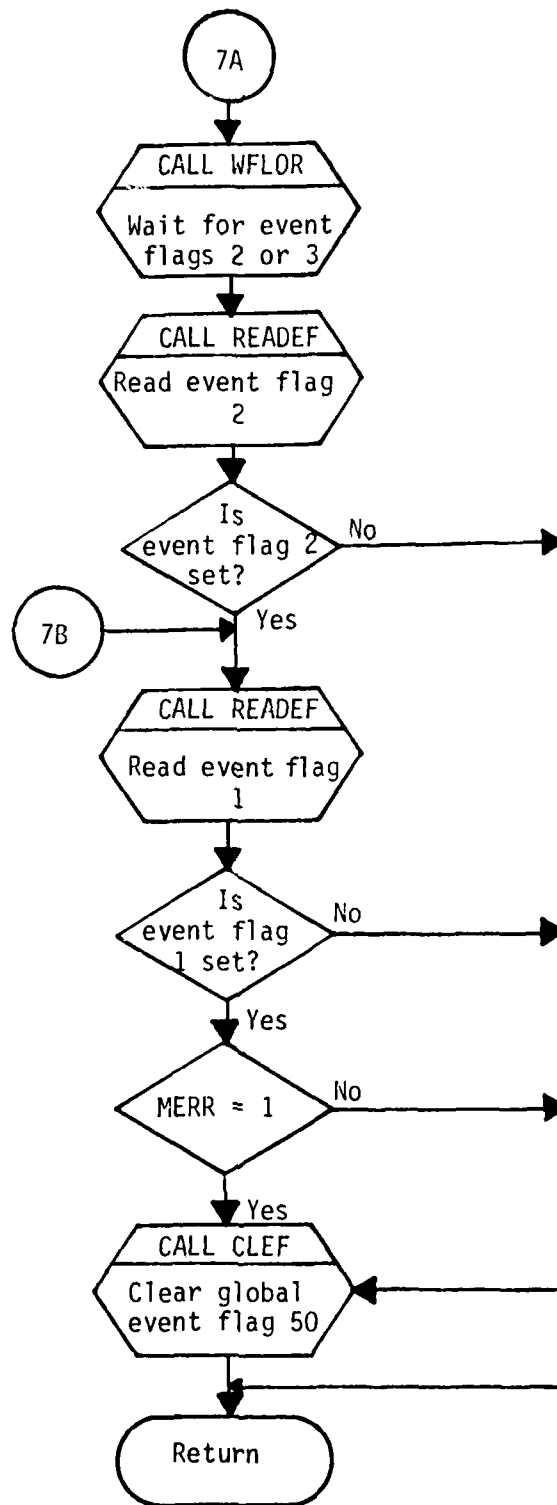
FLOW DIAGRAM

Figure 3-5
(Page 5 of 7)



TIME SERIES DATA FORMATTER
FLOW DIAGRAM

Figure 3-5
(Page 6 of 7)



TIME SERIES DATA FORMATTER
FLOW DIAGRAM
Figure 3-5
(Page 7 of 7)

<u>IEVENT</u>	<u>TYPE OF CHANGE</u>
1	Center Frequency Change
2	Filter Bandwidth Change
3	Quantization Change
4	Azimuth Change
5	Beam Band Change
6	Shading Coefficient Change
7	Designated Reference Hydrophone Change
8	Filter Coefficients 1 Change
9	Filter Coefficients 2 Change
10	Filter Coefficients 3 Change
11	A/D Control Word Change
12	IEVENTS 2 and 3
13	Set Time of Day
14	Buoy Position Change
15	Send Data Memory
16	Buoy Set to Inactive
17	Exit D.S. Operating System

PARAMETER CHANGE EVENTS

Table 3.1.3-1

IEVENTCONTENTS OF SDCBFR DATA FIELD

- 1 Thirty center frequency values from IFREQ1/2. Values are 16 bit integer and expressed in centihertz.
- 2 Thirty bandwidth values from ICTAP1/2. Values are 16 bit integer and expressed in hertz.
- 3 Thirty quantization level values from ICQTZ1/2. Values are 16 bit integer with the upper byte expressing the least significant bit number of bits.
- 4 Thirty actual azimuth values from ACTAZ1/2. Values are unsigned 16 bit integer and expressed in hundredths of degrees.
- 5 Thirty beam number values from IBEAM1/2. Values are 16 bit integer and range from 0-10 (zero being hydrophone designation).
- 6 Twenty-seven shading coefficients from SHAD1/2. Values are 16 bit integer. SHAD1/2 is dimensioned 28, the 28th value being the summation value for the designated hydrophone. This value is passed in the designate hydrophone event.
- 7 Two 16 bit words are passed. The first word is the designated hydrophone number (1-53) from IHYDR1/2 and the summation value of the shading coefficients from SHAD1/2 (28).
- 8 Nineteen 16 bit integer first second stage filter coefficients from FIR11/2.
- 9 Seventeen 16 bit integer second stage filter coefficients from FIR21/2.
- 10 Twenty-one 16 bit integer filter coefficients for the third thru sixth stages from FIR31/2.
- 11 Sixteen bit A/D control word. Upper four bits contain counts for gain value and lower three bits contain quantization level.

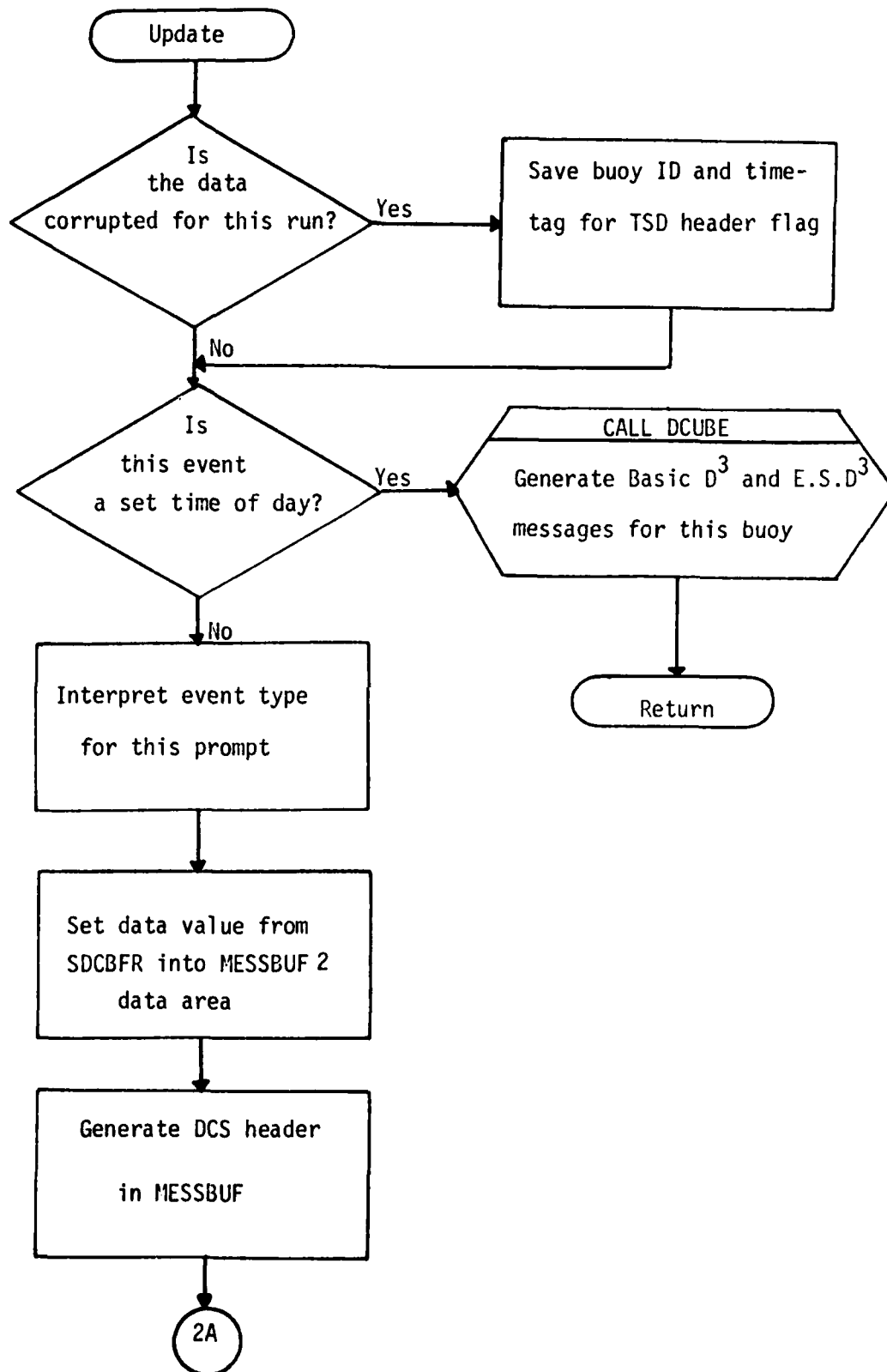
SDCBFR DATA VALUES
Table 3.1.3-2

(Page 1 of 2)

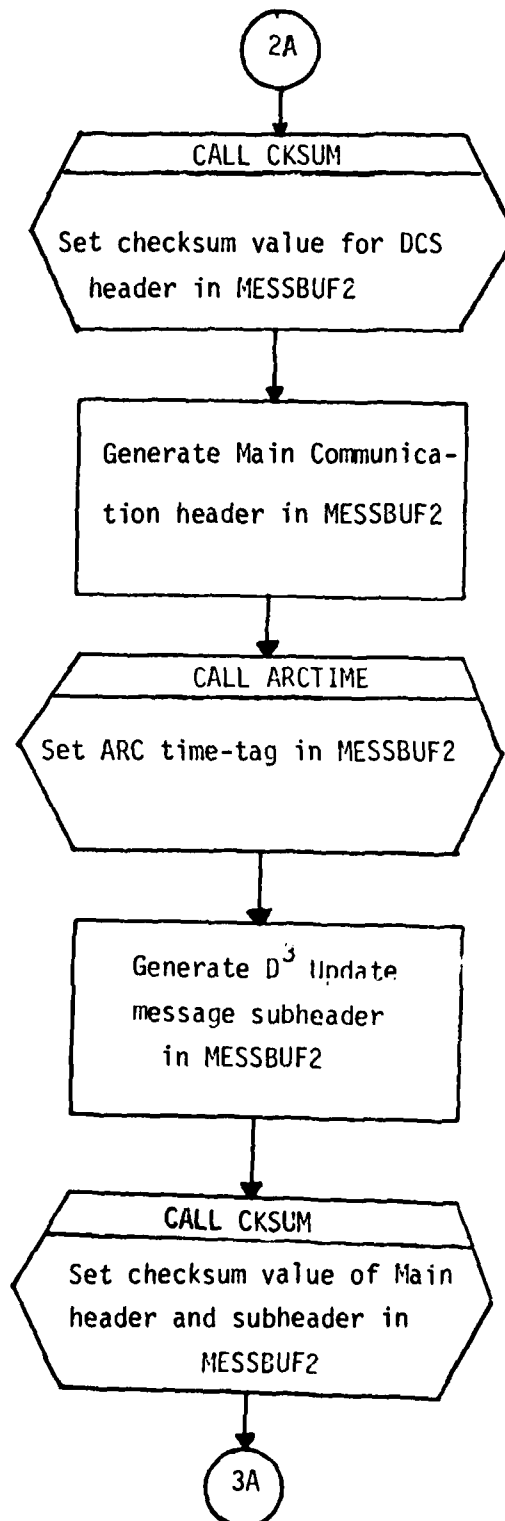
- 12 Thirty quantization level values (same as IVENT=3).
Bandwidth values will have to be retrieved by IPCT
from array ICTAP1/2.
- 13 Nothing is set in data field for time of day.
- 14 Nothing in data field for buoy position change. IPCT
will reference CBLAT1/2 and CBLNG1/2, both 32 bit
real values, and convert these values to a 32 bit
integer value in ten thousandth of degrees. CBT1M1/2
will be a 5 integer word array giving the position
time in days, hours, minutes, seconds, and milli-
seconds. LOCAT1/2 will contain the 16 bit ASCII
value to indicate the type of locator used (LC for
Loran C and SN for SATNAV).
- 15 No data in data field.
- 16 No data in data field.
- 17 No data in data field.

SDCBFR DATA VALUES

Table 3.1.3-2 (page 2 of 2)

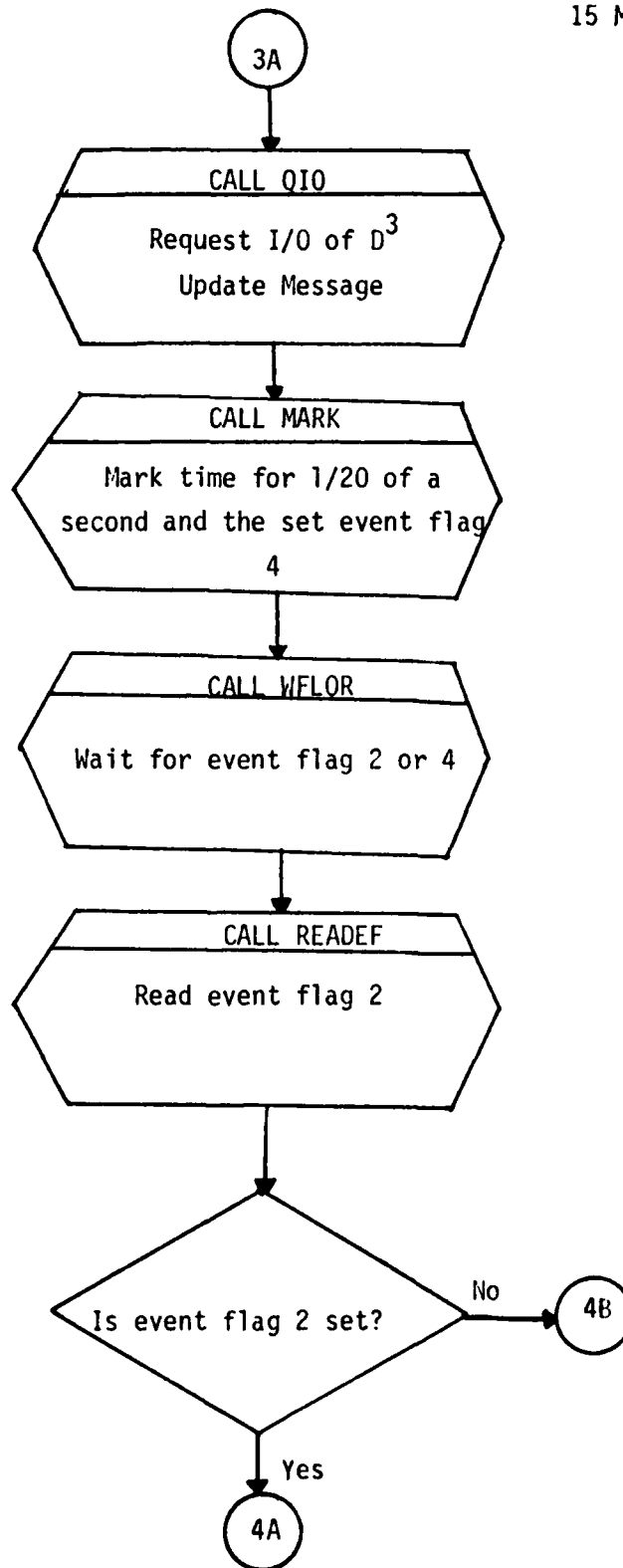


DATA DESCRIPTIVE DATA UPDATE FORMATTER FLOW DIAGRAM
Fig. 3-6 (Page 1 of 4)

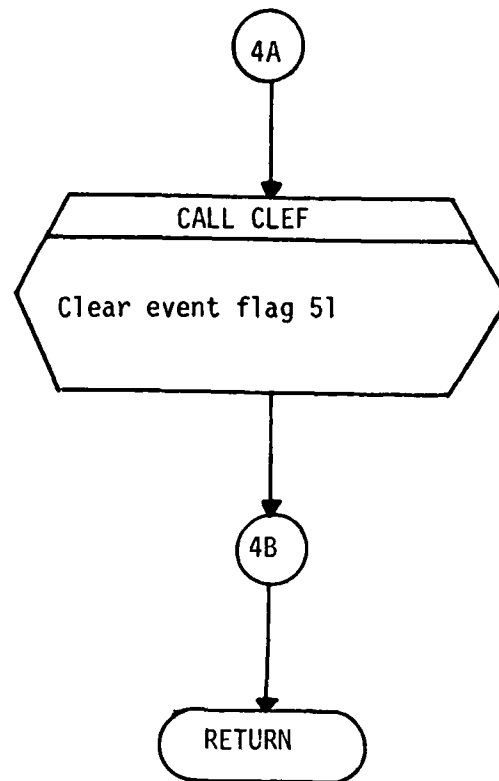


DATA DESCRIPTIVE DATA UPDATE FORMATTER FLOW DIAGRAM

Fig. 3-6
(Page 2 of 4)



DATA DESCRIPTION DATA UPDATE FORMATTER
FLOW DIAGRAM



DATA DESCRIPTION DATA UPDATE FORMATTER FLOW DIAGRAM

Fig. 3-6

(Page 4 of 4)

The ARC time-tag contained in the header of the update message is determined by calling subroutine ARCTIME with TIME as an input. Checksums for the header are determined by calling subroutine CKSUM. The data portions of a D³ update message contains a group type value, number of words value, and all values of the changed group regardless of the number of changes within the group. The group data values have the same definition as stated in section 3.1.1 for Basic Data Descriptive Data and Experiment Specific Data Descriptive Data messages.

Whenever this function senses corrupted data (IERROR), it sets an internal flag in order to set the appropriate header flags when generating time series data messages.

3.2 GLOBAL COMMON AREA

The Global Common Area contains the beam band buffers for deblocked data and variables of common use by the RCA software and Inter-Processor Communication task. The Inter-Processor Communication task will only have read access and the RCA software will be responsible for maintaining the data in the buffer.

The following list of data items are accessed by the Inter-Processor Communication task from the Global Common Area.

- ACAZR1/2 Contains the estimated acoustic rotation rate. Value is defined as 32 bit real with significance to a thousandths of a degree per minute.
- ACBER1/2 Contains the estimated acoustic bearing. Value is defined as 32 bit real with significance to a hundredths of a degree with respect to magnetic north.
- ACHDG1/2 Contains the estimated acoustic heading. Value is defined as 32 bit real with significance to a hundredths of a degree with respect to true north.

- ACTAZ1/2(30) Contains the current azimuth value of each beam-band pair. Each value is defined as 16 bit unsigned integer and expressed in hundredths of a degree with respect to true north.
- ACTIM1/2 (5) Contains the time-tag associated with the last operator input of the estimated acoustic heading and rotation rate. Each element in the array is defined as 16 bit integer with the array representing time in days, hours, minutes, seconds, and milliseconds from the beginning of the experiment year.
- AZRTE1/2 Contains the array rotation rate as determined from the tag compass value. Value is defined as 32 bit real with significance to a hundredths of a degree per minute.
- BBBUF (320,30) Contains ten seconds of deblocked time series data. Each column of the array contains the data for the corresponding beam-band number. The array is defined as 16 bit integer and each complex data sample is represented in 32 bits.
- CBLAT1/2 Contains the current buoy latitude. Value is defined as 32 bit real with significance to ten thousandths of a degree.
- CBTIM1/2 (5) Contains the time-tag associated with the current buoy position. The array is defined as 16 bit integer and contains time in days, hours, minutes, seconds, and milliseconds from the beginning of the experiment year.
- CFREQ1/2 (30) Contains the current center frequency of each beam-band pair. Each value is defined as 16 bit integer and expressed in centihertz.
- COMPS1/2 Contains the current tug compass value. Value is defined as 32 bit real with significance to a hundredth of a degree.
- FIR11/2 (19) Contains the first stage filter coefficients. Values are defined as 16 bit integer.
- FIR21/2 (17) Contains the second stage filter coefficients. Values are defined as 16 bit integer.

- FIR31/2 (21) Contains the third-sixth stage filter coefficients. Values are defined as 16 bit integers.
- HEADG1/2 Contains the array heading as determined from the tug compass. Value is defined as 32 bit real with significance to a hundredth of a degree with respect to true north.
- IACFG1/2 Contains a boolean flag indicating whether the tug compass or the acoustic bearing is used update the actual azimuth values: TRUE indicates acoustic bearing and FALSE indicates tug compass.
- IACTV1/2 Contains a boolean flag indicating the activity of the buoy. TRUE indicates buoy is active.
- IADCL1/2 Contains the A/D control word. Value is 16 bit integer with the upper four bits specifying gain in counts or a value signaling Automatic Gain Control and the lower three bits specifying a quantization level code.
- IBEAM1/2 (30) Contains the beam number (0-10) associated with each beam band pair. A zero value indicates that a hydrophone is associated with that beam-band. Values are defined as 16 bit integer.
- IBYID Contains the current buoy identification (1 or 2) associated with the prompt from the File and Real-time Management Task. Value is 16 bit integers.
- ICQTS1/2 (30) Contains the current quantization level associated with each beam band pair. Values are defined as 16 bit integer with the upper byte expressing the least significant bit number and the lower byte expressing the number of bits.
- ICTAP1/2 (30) Contains the current bandwidth associated with each beam band pair. Values are defined as 16 bit integer and expressed in hertz.
- IDBID Contains the default buoy identification. When the demultiplex task prompts IPCT, this value will contain the buoy I.D. (1 or 2) associated with the data in BBBUF. Value is 16 bit integer.

- IDMXFG Contains a boolean flag indicating the existence of demultiplexed data in BBBUF. FALSE indicates data in BBBUF.
- IERROR Contains the data quality error event. This value is set by the File and Real-time Management Task before prompting IPCT to indicate the quality of the data in a reply message. Value is 16 bit integer.
- IEVENT Contains an event number which indicates a change to the Deployed System state. This value is 16 bit integer and is set by the File and Real-time Management Task before it prompts IPCT.
- IGAIN1/2 Contains the current gain value in db. Value is 16 bit integer and reflects either the shore designated gain or the AGC gain.
- IHYDR1/2 Contains the designated hydrophone number. Value is 16 bit integer.
- IQCS1/2 Contains a boolean flag indicating whether the quantization control was automatic (determined by software) or manual (input by operator). TRUE indicates automatic.
- ISEQ1/2 Sixteen bit integer value containing number indicating the last updated environmental sensor value. A value of 1-11, respectively, corresponds to compass, pressure 1-3, tension, lock 1-3, sigma square, and buoy latitude and longitude. A value of zero indicates no update and a value of 69 indicates just an acoustic bearing update.
- LOCAT1/2 Contains an ASCII string indicating the type of locator used to determine the buoy position. "SN" indicates SATNAV and "LC" indicates Loran C. Value is defined as 16 bit integer.
- LOCK11/2 A 16 bit integer containing the lock status of the hydrophone multiplex channels 1-11.
- LOCK21/2 A 16 bit integer containing the lock status of the hydrophone multiplex channels 12-22.

- LOCK31/2 A 16 bit integer containing the lock status of the hydrophone multiplex channels 23-27 and environmental sensors for pressure 1-3, tension, and compass.
- PRSR11/2 A 32 bit real value containing the depth of pressure sensor 1. Significance is to a tenth of a meter.
- PRSR21/2 A 32 bit real value containing the depth of pressure sensor 2. Significance is to a tenth of a meter.
- PRSR31/2 A 32 bit real value containing the depth of pressure sensor 3. Significance is to a tenth of a meter.
- SDCBFR (33) Contains the D^3 prompt information passed to IPCT by the File and Real-time Management Task. Values are defined as 16 bit integer with the first 3 words equivalenced to IBYID, IERROR, and IEVENT. The remaining 30 words will contain data changes as related to the D^3 event.
- SHAD1/2 (28) Contains the 27 shading coefficients with the 28th entry containing the shading coefficient summation value for the designated hydrophone. Values are defined as 16 bit integers.
- SIGSQ1/2 A 32 bit real value containing the variance of the input hydrophone data.
- SLAT A 32 bit real value containing the communication satellite latitude with significance to ten thousandths of a degree.
- SLONG A 32 bit real value containing the communication satellite longitude with significance to ten thousandths of a degree.
- TENSNI/2 A 32 bit real value containing the array tension with significance to a tenth of a pound.
- TIME (5) Contains the time-tag₃ of the information associated with the D^3 update prompt received from FROM or the time-tag associated with the initialization data. Each element in the array is defined as 16 bit integer with the array representing time in days, hours, minutes, seconds, and milliseconds from the beginning of the experiment year.

- TIMX (5) Contains the time-tag of the data associated with the prompt received from the Demultiplexer function. Each element in the array is defined as 16 bit integer with the array representing time in days, hours, minutes, seconds, and milliseconds from the beginning of the experiment year.

4.0 INTER-PROCESSOR COMMUNICATION/DCS/KMC/NCP

Data is double buffered in the Inter-Processor Communication task and passed to the Data Communication Subsystem task via the system directive QIO. The parameter list in the QIO directive supplies the necessary information for DCS to route the data packet via the KMC/DMC-FA to the 11/70 Network Control Programs. DCS will generate NO-OPS in 3-5 second interval if no data sets are being transmitted in that time period. This is to communicate the activity of the line to NCP.

The 200 kilo bit data-rate capability of the DMC-FA will adequately support the maximum Deployed System data rate of approximately 170,000 bits per five second interval.

5.0 UTILITY CONTROL SYSTEM (11/70)

The user Control Subsystem (UCS) initializes the topology of the nodes, ports, and links on the 11/70. For Deployed Sensor, the node configuration will consist of the three remote sites, the 11/34, NCP, Archiver, Demux, Spooler, Despool, D.S. Gram Data Manager, and the Applications Software. These nodes route the data through the defined topology via the Network Services Programs (NSP).

All data that is received by NCP will be passed to the Archiver to be recorded on tape. In addition to the tape header, the state table will be recorded at the beginning of each tape. The DEMUX node will receive all time series data and associated D³ messages. The data is processed and passed to the SPOOLER node which writes the data onto spools on the disk.